REMARKS

Drawings

Applicant requests confirmation that the drawings submitted March 29, 2003 (in amendment D, received June 2, 2003) have been entered and approved.

Priority Claim

Applicant requests confirmation that the claim of priority to Provisional Application 60/145,286, which is found in the PCT application and in the filing receipt for this application, and which was entered in the first paragraph following the title in applicant's amendment dated March 29, 2003 (received June 2, 2003) has been accepted and entered. Although the claim of priority was recognized in the filing receipt, applicant's attorney notes that the PAIR system does not show that priority.

Abstract

The abstract has been amended as suggested by the Examiner.

Status of claims

Several claims have been canceled, all without prejudice to applicant's right to refile them in a continuation or divisional application. In particular, the claims copied, or substantially copied, from McGeer, U.S. Patent No. 6,264,140, have been made the subject of a divisional application filed January 9, 2004.

Claim 130 has been allowed.

Claim 132 has been rewritten to be dependent on allowed claim 130 and should be allowable with it.

Claim 133 has been allowed.

Claim 141 has been allowed.

Claim 147 has been rewritten in independent form. It has been indicated as allowable if so rewritten.

Claims 151-153 have been amended to be dependent on claim 209, which is discussed hereinafter.

Claim 157 has been amended to be dependent on claim 261, which is discussed hereinafter.

Claim 177 has been amended to be dependent on claim 257, which is in turn dependent on claim 212, discussed hereinafter.

Claims 184 and 185 have been allowed.

Claim 209 and its dependent claims 210-211 are discussed hereinafter.

Claim 212 and its dependent claims 213-214 are discussed hereinafter.

Claims 216-217 and 220 have been amended to be dependent on claim 258, which is discussed hereinafter.

Claims 221 and 226 have been rewritten in independent form. They have has been indicated as allowable if so rewritten.

Claims 227-228 have been amended to be dependent on claim 212, which is discussed hereinafter.

Claim 229 has been rewritten in independent form. It has been indicated as allowable if so rewritten.

Claim 230 has been amended to be dependent on claim 212, which is discussed hereinafter.

Claim 231 is discussed hereinafter.

Claim 238 and its dependent claims 245-246 are discussed hereinafter.

Claim 248 has been rewritten in independent form. It has been indicated as allowable if so rewritten.

Claims 251 has been allowed.

Claim 257 has been amended to be dependent on claim 212, which is discussed hereinafter.

Claims 258 and its dependent claim 259 are discussed hereinafter.

Claim 260 is discussed hereinafter.

Claim 261 is discussed hereinafter.

Claim 262 has been rewritten in independent form. It has been indicated as allowable if so rewritten.

Claim 279 is discussed hereinafter.

Claim 280 is discussed hereinafter.

Claim 281 and its dependent claim 282 have been amended and are discussed hereinafter.

Claim 285 is discussed hereinafter.

Claim 286 and its dependent claims 287-288 have been amended and are discussed hereinafter.

Claim 289 has been amended and is discussed hereinafter.

Claim 292, newly added, is directed to the use of a forward-extending capture device, and is separately discussed hereinafter.

Claim rejections

Applicant appreciates the Examiner's care in reviewing the claims, and his grasp of the issues in a telephone interview with applicant and his undersigned attorney on December 9, 2003.

In the telephone interview, the applicant and his attorney made the following argument.

In a system like the one disclosed in the present application or in McGeer, U.S. Patent 6,264,140, as the aircraft hits a vertically oriented arrestment line a wave is created in the arrestment line which travels up (and down) the line until it hits a restraint such as a support beam. The restraint causes the wave to reflect back down (or up) the arrestment line. If the arrestment line is not yet captured by the wing hook, the wave can throw the line off the leading edge of the wing and away from the hook resulting in an unsuccessful capture.

With a swept wing configuration, the arrestment line is very rapidly and powerfully driven to the arrestment hook and is held by the latch mechanism on the arrestment hook designed to retain the arrestment line. This may occur significantly before the aircraft even starts to yaw due to the arrestment loads.

The present inventor believes there are at least three benefits of the swept wing approach:

1) IMPROVED PROBABILITY OF A SUCCESSFUL CAPTURE

The arrestment line is very rapidly driven to the arrestment hook by the swept wing before the reflected wave can travel back up or down the line and

throw the arrestment line away from the wing leading edge and away from the hook, potentially resulting in an unsuccessful capture.

With a straight wing design the aircraft may first have to yaw before the arrestment line will want to start sliding toward the hook. If the arrestment line contacts the wing near the fuselage there is only a very small moment arm from the arrestment load to the vehicle center of gravity to cause the aircraft to yaw (see Figure 1). Theoretically if the straight wing aircraft is yawed significantly in the wrong direction due to rudder inputs or cross-wind conditions, etc., the arrestment line could still hit outboard on the wing and slide inboard to the root where again there is very little moment arm to yaw the aircraft.

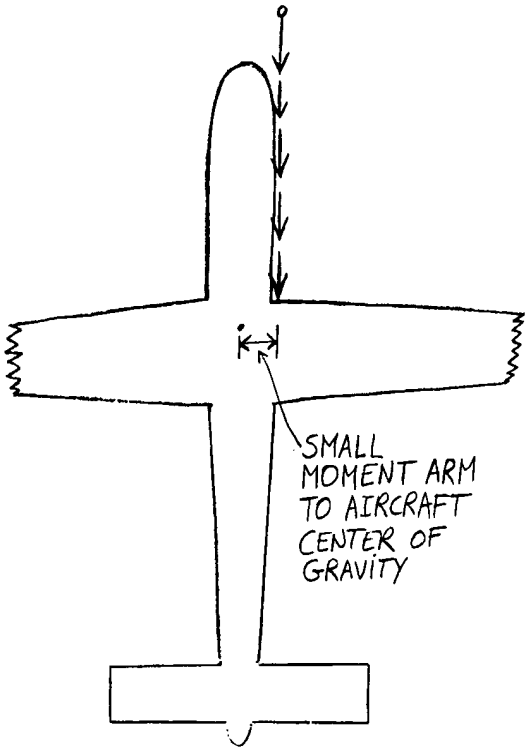


FIGURE 1

2) LIGHTER WEIGHT WING LEADING EDGE

With a swept wing design the arrestment line can be rapidly swept into the hook before the arrestment loads get very high. In addition the recovery system's energy absorbing mechanism can be designed to accentuate this effect by initially providing an especially low bungee load on the arrestment line until after the line has been pulled out a short distance and the line has already been be swept into the hook. In this way the entire leading edge of the wing does not have to be designed for the higher arrestment loads. This is not possible with a straight wing design where the loads on the arrestment line have to be large enough to rapidly yaw the aircraft before the arrestment line will start to slide toward the hook.

3) MORE OPERATIONAL FLEXIBILITY WITH LESS SUSCEPTIBILITY TO AIRCRAFT YAW ANGLES

The present inventor believes that the sweep-back on the wing provides a larger range of acceptable aircraft yaw angles (relative to the direction of travel) for safely recovering the aircraft. These yaw angles could come from rudder inputs, cross-winds or just the naturally yawing motion of the aircraft. Thus, the sweep back on the wing means that the aircraft (or its operator) needs to worry less about making cross-wind landings.

In response to this argument, the Examiner indicated that although he understood that the claims including a swept structure which guides the arrestment line laterally to a capturing device on the aircraft were novel and produced unexpected results, he would like applicant to present reasons that a

swept-wing aircraft could not be simply substituted for the straight-wing aircraft disclosed by McGeer. The following is in response to that request.

Although there are swept wing UAVs (Unmanned Aerial Vehicles) the majority of non-helicopter UAVs have a straight wing. Per the Office of the Secretary of Defense website at www.acq.osd.mil/usd/uav_roadmap.pdf the current US military UAV Operational Systems are the MQ-1 Predator, RQ-2 Pioneer, RQ-5 Hunter and RQ-7 Shadow 200. All of these UAVs have straight wings with little or no aft wing sweep.

On the OSD website under developmental UAV systems is listed the RQ-4 Global Hawk, Broad Area Maritime Surveillance, RQ-8 Fire Scout, MQ-9 Predator B, Dragon Eye, Force Protection Aerial Surveillance System (FPASS), Neptune, Air Force UCAV (X-45), UCAV-Navy (X-46/X-47), UCAR, and Dragon Warrior. The UCAV (Unmanned Combat Air Vehicles) have swept wings in order to fly fast and are large fighter sized aircraft and thus would be difficult to recover using the current invention. The Fire Scout, UCAR and Dragon Warrior are helicopters. Based on the pictures in the OSD website it appears that Neptune is the only slow flying swept wing UAV listed as being in development and there are none listed as being operational. The reason for the swept delta wing like shape in the case of Neptune is probably related to its primary recovery approach which is landing in water. Impact of a straight wing with a wave could cause higher attitude upsetting and impact loads and the thick wing root of a delta wing provides good strength to better handle these loads. The FPASS uses a straight wing with what appears to be a small amount of aft sweep in the

outer wing panels which may be a subtle aerodynamic refinement or may be to make it look more like a bird.

It is believed that the higher number of straight wing aircraft is because of some obvious and not so obvious advantages of straight wing designs for these slower flying aircraft. More obvious advantages include the simplicity of the design with a straight continuous spar through the fuselage and the aerodynamic and structural efficiency for these slow flying aircraft. An example of a less known and less obvious advantage for a small straight wing UAV is that they have often been mistaken for birds and thus can draw less attention which has some advantages especially for military missions

Although not obvious, the advantages of using a swept wing design when using the current recovery system easily overcomes any advantages of a straight wing design.

Incorporating this recovery system onto a swept wing UAV, however, is not as simple as just putting the latching hooks from a straight wing design on the wingtips of an existing swept wing UAV. Airframe components can interfere with the proper operation of the recovery system. For example the pitot static tube wants to extend forward into clean air in front of the aircraft for proper operation. So if the aircraft pitot-static tube isn't located right near the centerline of the vehicle with a smooth unobstructed path for the arrestment line to slide along the fuselage sides and wing leading edges uncluttered by antennas, wing snags, fences, fasteners, etc. then the arrestment line can get hung up and not get to the hook. If the aircraft has a conventional forward mounted engine and

propeller it is not obvious how to prevent the arrestment line from getting tangled in the propeller. Some swept wing aircraft have straight canard wings in front of the swept wing which also could interfere with this recovery approach.

The wings on most UAVs can be removed. If there is a tiny gap between these wing elements or a soft spot or a tiny step in the leading edge structure in the wrong direction the line can also catch and dig in. One way to help prevent this is to have the inboard structure always overlap the outboard structure. Many aircraft have ribs or stiffeners periodically spaced laterally to support the wing leading edge structure. As a result the leading edge structure can be significantly stiffer directly in front of a rib or stiffener than between the ribs or stiffeners. The load from the arrestment line can cause a flexible structure to deflect and cause a local valley also preventing the sliding of the arrestment line. If the arrestment line stops sliding and the load on the top and bottom of the arrestment cable is not exactly matched the line can start sliding up or down and cut into the structure.

Even if the arrestment line slides smoothly to the hook the arrestment loads at the hook will usually require a significant redesign if not a new wing design. This is because the wingtip of a UAV normally doesn't see much load and so there normally is little structure there. Also the wing of a UAV doesn't often see large loads pulling aft and outboard on a wing like it experiences with this kind of arrestment. The component of the arrestment load pulling outboard on the wing comes about primarily because the aircraft will tend to yaw toward the side that has engaged the arrestment line. This generally will rotate the wing

to line up lengthwise more in the direction of flight and in the orientation of the primary arrestment load.

It is believed that the foregoing discussion shows the unobviousness of the invention claimed in claims 151-153, 157, 177, 209-214, 216-217, 220, 227-228, 230, 231, 238, 245-246, 257-261, 279- 282, 285, 287, and 289.

Claims 286 and 288

Claim 286 and its dependent claim 288 recite that the hook is "mounted on an outboard portion of the at least one wing." As shown by the copies of the priority documents (provisional applications) submitted herewith, the McGeer provisional application made use of a slot cut into the end of the wing (and even talked of taping over it to provide a smooth leading edge), rather than a separate hook element mounted on the wing. The hook is disclosed as a separate element in applicant's priority document (provisional application).

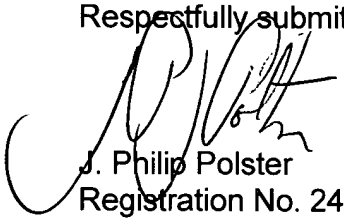
Claim 292

Newly presented claim 292 is directed to a combination in which a capture device mounted on an outboard portion of an aircraft wing, "extends forward of a line along a leading edge of the wing extending more than twenty percent of the length of the leading edge, ... the forward-extending capture device being proportioned to capture the fixture even when the fixture is forward of said line." As shown by the copies of the priority documents (provisional applications) submitted herewith, the McGeer provisional application made use of a slot cut into the end of the wing (and even talked of taping over it to provide a smooth leading edge), rather than a forward-extending capture device. The forward-

extending capture device on the outboard portion of the wing helps provide a reliable capture system, and is neither shown nor suggested by the prior art.

It is respectfully requested that the claims now presented be allowed and the case passed to issue. Should the Examiner have questions or suggestions, he is requested to call applicant's undersigned attorney, J. Philip Polster, at the number below or at his direct dial number, 314-238-2426.

Respectfully submitted,



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